Appendix A14.3: Aerial Imagery Analysis

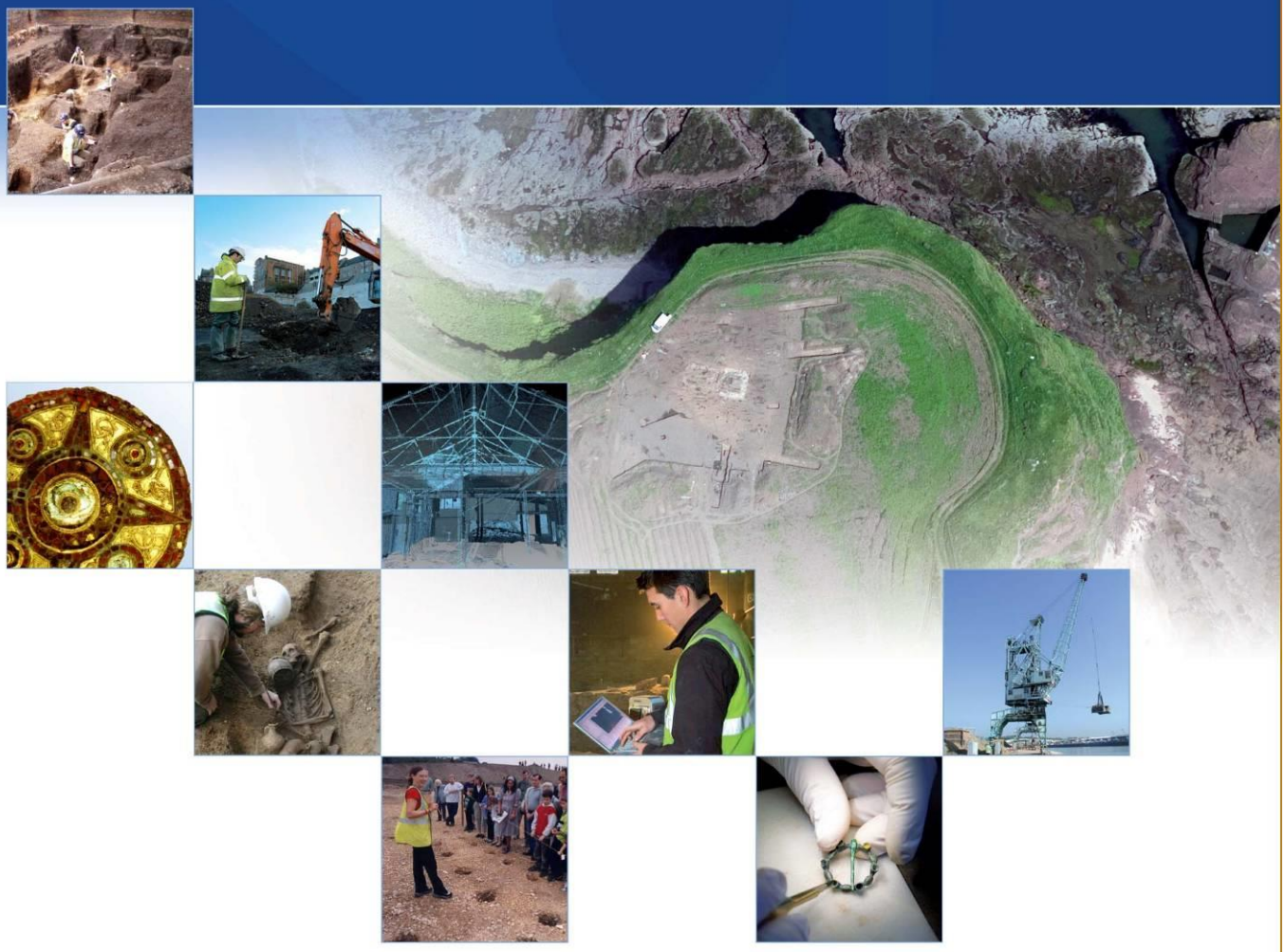
A9/A96 Inshes to Smithton
Inverness, Scotland

Aerial Imagery Analysis

National Grid Reference: NH 69863 45203

AOC Project No: 51877b

Date: 6th July 2018



AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

A9/A96 Inshes to Smithton

Inverness, Scotland

Aerial Imagery Analysis

On Behalf of:

Jacobs UK Ltd
160 Dundee Street
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National Grid Reference (NGR): **NH 69863 45203**

AOC Project No: **51877b**

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This document has been prepared in accordance with AOC standard operating procedures.

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Non-Technical Summary

AOC Archaeology Group was commissioned by Jacobs UK Ltd to undertake an assessment of the available aerial imagery of 12 parcels of land relating to the A9/A96 Inshes to Smithton Scheme. Images from the National Record of the Historic Environment (NRHE) and National Collection of Aerial Photography (NCAP) collections were assessed, georeferenced and visible features were digitised in a Geographical Information System (GIS). Evidence for prehistoric settlement in the form of possible ring grooves and ring ditches, pits and linear features were identified, mainly located in Parcel 7.

1 Introduction

1.1 AOC Archaeology Group were commissioned by Jacobs UK Ltd (hereafter 'Jacobs') to undertake an assessment of the available aerial photography of the development area, as part of a wider scheme of archaeological assessment for the A9/A96 Inshes to Smithton scheme. This work is being carried out on behalf of Transport Scotland with the Highland Council Historic Environment Team as the Curator.

1.2 Aerial images held by the National Collection of Aerial Photography (NCAP) and the National Record of the Historic Environment (NRHE) were consulted and digital copies obtained. Each available image was inspected and any visible features were digitally transcribed.

2 Site Location and Description

2.1 The twelve parcels of land designated for assessment are located less than a mile to the east of the A9/A96 junction, east of Inverness Retail and Business Park and north of the Inverness College, University of the Highlands and Islands campus. The area designated for assessment is centred at NH 69863 45203 (see Figure 1).

2.2 The survey parcels (hereafter the 'site') collectively cover an area of approximately 25.45ha across pasture and arable stubble fields. The site has an undulating topography and slopes down gradually towards the north, ranging in height from 40m aOD (above Ordnance Datum) in the south to 20m aOD in the north (see Figure 2).

2.3 The bedrock recorded geology within the site consists of the Hillhead Sandstone Formation; a sedimentary Devonian sandstone formed in an environment previously dominated by rivers (BGS 2017).

2.4 The bedrock is overlain by drift deposits including: made ground; alluvium; a variety of Flandrian and late Devensian raised marine deposits; and late Devensian glacial deposits. Made ground is expected to be locally derived and generally limited to areas of existing road or railway embankment.

2.5 Alluvial deposits within the site are generally located underlying the flood plains of existing burns. They are normally comprised of soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.

2.6 Raised marine deposits are located in the north of the site, approximately along the line of the A96 Inverness to Aberdeen Trunk Road, and are comprised of a mixture of gravel and sand, which is commonly silty. Gravel is typically cobble grade and poorly sorted, while sand is mainly medium-grained.

2.7 Late Devensian raised tidal flats are described as silt, clay and fine-grained sand with lenses of gravel, and are located north of Smithton, in the eastern portion of the site.

2.8 Glacial deposits within the site include glaciofluvial sheet deposits, glaciomarine silts, hummocky glacial deposits and till. These are all overlain by Humus-iron podzols derived from fluvioglacial and raised beach sand parent materials (Scotland's Soils 2018).

2.9 The varied nature of the geology of the site means that visibility of archaeological cropmarks is similarly varied. Geophysical survey carried out as part of the heritage assessment for the A9/A96 Inshes to Smithton Scheme indicated that the most highly visible features were located on raised gravel ridges, with visibility diminishing away from the higher ground. This is mirrored in the aerial photography evidence.

3 Archaeological Background

3.1 The archaeological background below is drawn from sites recorded in the National Record of the Historic Environment (NRHE 2018).

3.2 Two heritage assets are recorded by the NRHE as being located within the site boundary; both of which have unassigned periods.

3.3 The Scheduled Monument of "Ashton Farm Cottages, Ring Ditch 415m SW And Pit Circles 460m WSW Of" (SM11535) is located in Parcel 7. Located through aerial photographs taken in 1982, 1989 and 1995; the features consist of a 'Field Boundary, Pits and an Unenclosed Settlement' (Site no. NH64NE 99, Canmore ID 13457) and a 'Ring Ditch' (Site no. NH64NE 39, Canmore ID 13391). All features are undated but are likely to be prehistoric in date. Canmore gives the sites the name 'Drumrosach', and describes them as follows:

> "**NH64NE 99**. The cropmarks of two pit-circles have been revealed by oblique aerial photographs (RCAHMSAP 1982, 1989, 1995), 900m SE of Stoneyfield House (NH64NE 159). The pit-circles (NH c.6975 4509 and NH c.6976 4511) both have a double line of pits on at least one side and they have an internal diameter of about 12-15m.
>
> **NH64NE 39. NH 698 450.** Air photography has revealed the crop-mark of a ring-ditch 200 m NE of Drumrosach farmsteading. It is pennanular in shape and measures about 6 m in diameter within a ditch 1 m wide which has a gap 2 m wide on the SE side."

3.4 The cropmark of a possible prehistoric barrow has also been located through aerial photography, just to the south of the survey area in Parcel 2. The 'Barrow and Enclosure' (Site no. NH74NW 112, Canmore ID 146154) are adjacent to a number of other indeterminate cropmarks and pits in the surrounding area; some of which may have been located in the geophysical survey data.

4 Previous Work

4.1 In order to assess the concordance of the geophysical survey results with the available aerial photography, comparison was made between photographs held by the NRHE by Historic Environment Scotland (HES) and the geophysical data obtained during survey works carried out in early 2018. The results of this comparison were set out in the report on the geophysical survey results (AOC 2018).

4.2 Features identified in Parcel 7 by HES had previously been transcribed, and comprise structures in two areas (see HES C52911.dxf, held in HES archive); this transcription forms the basis for the Scheduling designation (SM 11535). The features identified in the aerial image and transcribed by HES comprise a probable ring-ditch house c.9m in diameter (though the Scheduling document states 6m) defined by a ditch 1m in width, with an entrance on the south eastern quadrant (eastern site) and a group of pits forming at least two probable roundhouses 10m in external diameter (western site). A scatter of related pits is visible surrounding the roundhouses.

4.3 However, it was noted that the position of the ring ditch NH64NE 39 was offset from the correct position, identified through resistivity survey, by c.7m to the north west (see AOC 2018).

5 Methodology

5.1 All of the available aerial photographs held by the NRHE and NCAP for the survey parcels were consulted, and digital copies obtained. A full list of images is included in Appendix 1.

5.2 Images were georeferenced using ArcGIS Pro 2.1.3, using a projective transformation and a minimum of five control points per image. Owing to the general lack of reliable control points in the aerial images, ESRI aerial imagery was used for georeferencing. Control points were selected in British National Grid coordinate system (EPSG:27700).

5.3 Following georeferencing, visible archaeological features were transcribed as polylines and polygons in ESRI file geodatabase feature class format, with the following attributes (Table 1):

HES_Image	Class	Description	Confidence	Study_ID
HES Image reference from which the feature was digitised	*General interpretation of feature*	*Descriptive notes on feature*	*Confidence in the identification: 1: Low confidence, 2: Medium confidence, 3: High confidence*	*Feature identifier used in this study*

Table 1: Transcribed data schema.

5.4 Each feature was assigned a 'Confidence' rating, between 1 and 3 where '1' indicates a low level of confidence that the feature identified reliably indicates the presence of archaeology and '3' indicates a high level of confidence. These confidence levels are used to colour code the features depicted on Figures 18 and 19 of this report.

5.5 In addition, LiDAR data provided by Scottish Remote Sensing Portal was used to provide topographic context for the features identified. This 'first return' elevation model is used in Figures 2 and 19 in order to illustrate the position of each feature within the survey area.

6 Results and Interpretation

6.1 The aerial images available for the survey parcels were not generally productive, with archaeological features identified in only four of the 12 parcels assessed. The most productive images, however, were those of Parcel 7, where the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) reconnaissance had targeted the known features comprising SM 11535, resulting in more and better quality imagery than for the other parcels. Nonetheless, several features likely to indicate the presence of archaeological remains were identified.

Georeferencing

6.2 The majority of aerial images providing evidence for archaeological features were obliques with few suitable control points for accurate georeferencing. As such, it was necessary to rely on field boundaries, fences/fenceposts and bridges to georeference the images. In consequence, the reliability of the georeferencing is reduced, and variability in the location of individual features displayed on several images is incurred. Rectification residuals were generally in the region of 1m for each image georeferenced; however, given the variability in the resulting rectified images, it is estimated that the positional accuracy of each feature is in the region of 1m to 3m on average. For this reason, it is

important to note the image reference from which each feature was digitised in order to assess the reliability of each identification.

General Observations

6.3 As noted above, the varied sand/gravel geology of the surveyed area results in a high degree of variation in the visibility of archaeological cropmarks. Large numbers of possible isolated pits are visible across the images assessed; where these could not be reliably associated with other archaeological features they were not digitised.

Parcel 1

6.4 No features were identified.

Parcel 1A

6.5 No features were identified.

Parcel 2

6.6 No features were identified.

Parcel 3

6.7 No features were identified.

Parcel 4

6.8 In Parcel 4, a linear feature is visible running east/west on vertical aerial images (AOC_AP32). This is considered likely to relate to a previous field boundary. The feature was not detected by the magnetometry survey.

Parcel 5

6.9 No features were identified.

Parcel 6

6.10 No features were identified.

Parcel 7

6.11 The largest number of features were identified in Parcel 7. HES transcription identifies three probable post-defined roundhouses in the east area of SM 11535, the two southernmost of which have defined porch-type entrances on the west sides. The example to the north is somewhat smaller and no entrance is visible, though this could relate to differential survival or visibility in aerial imagery. The three structures are associated with a series of pits, some of which are relatively large and could indicate the presence of further structures.

6.12 Inspection of additional images suggests the presence of a possible further structure (AOC_AP13, Figures 3 and 18), perhaps a ring-ditched roundhouse or similar structure. 14m to the northwest of this feature, a dark curvilinear feature is visible, 12m in length and 3.7m in width. Though the identification is tentative, it is possible that this feature is a souterrain associated with the roundhouse settlement.

6.13 To the north of the Scheduled Monument, an elongated oval feature, possibly a further structure, has been tentatively identified (AOC_AP16). The feature is aligned northeast/southwest and is 13.2m by 8.1m.

6.14 HES identify a ring-ditch in the east area of SM 11535, though as noted above, geophysical survey suggests this feature is in fact located c.7m to the southeast of the position indicated by HES (AOC 2018, Figure 36). Rectification of further images introduces further variability in the position of this ring ditch for the reasons discussed above, but several support the position of the feature as identified by geophysical survey, centred on 269879, 845041. Inspection of further images suggests that this feature may not be isolated, with indications of further possible ring grooves to the northwest (AOC_AP6, AOC_AP7 and AOC_AP8), with additional roundhouse structures, perhaps of ring-ditched form, to the west and northwest (AOC_AP9 and AOC_AP10/11).

6.15 In the north of Parcel 7, a likely ring groove (the curvilinear slot usually indicating the presence of a prehistoric roundhouse) was identified during assessment of image C52911 as part of the geophysical survey (AOC 2018: Figure 19). This was labelled in this study as AOC_AP1 and is associated with three pits, AOC_AP2, 3 and 4. Around 30m to the southeast of this feature, a fragment of curvilinear ditch, possibly the remains of a ring-groove structure are visible (AOC_AP17), while a dark annular feature 9.5m in diameter near the centre of the field may indicate the presence of a further structure (AOC_AP12).

6.16 Close to the northern extent of Parcel 7, two possible linear features, perhaps ditches, are visible. The easternmost of these, AOC_AP18 is perhaps the more reliably identified of the two, and comprises a branching linear ditch running approximately north/south (Figures 3, 18 and 19). To the east, AOC_AP19 comprises an interrupted ditch curving from north to southeast in orientation (Figures 3, 18 and 19).

Parcel 8

6.17 In the southwest corner of Parcel 8, an isolated pit 3.2m across may be archaeological in origin (AOC_AP20, Figure 5). Around 40m to the northeast, three features (AOC_AP21-23, Figure 8) may indicate the presence of two ring-grooved houses (prehistoric roundhouses featuring a continuous curvilinear wall slot) and a ring-ditch (a prehistoric roundhouse featuring a characteristic crescentic ditch within the interior).

6.18 In the north east arm of Parcel 8, a series of linear ditch-like features are visible running north/south (AOC_AP24-28, Figures 3, 18 and 19); these are tentatively identified and may be geological in origin. Similarly, an isolated pit near the south eastern extent of the field is tentatively identified (AOC_AP29, Figures 3, 18 and 19).

Parcel 9

6.19 Few features were recorded in Parcel 9. Most significant is a possible linear feature (AOC_AP5), curving from the north to southwest and running for a length of c.155m. In addition, HES have recorded the presence of three possible pits near the north boundary of the field (Figures 18 and 19), though these are not clearly associated with other features.

Parcel 10

6.20 No features were identified.

Parcel 10A

6.21 No features were identified.

Other features

6.22 Two additional features (AOC_AP30 and AOC_AP31) were recorded on image C_53549, outside the site. These comprise a probable ring-grooved roundhouse with internal pits, and a possible further roundhouse evidenced by a circular depression containing wetter soils.

7 Conclusions

7.1 The aerial imagery assessment has highlighted the likely presence of several archaeological features within the site of the A9/A96 Inshes to Smithton Scheme. Taken with the results of the geophysical survey, these results point to a concentration of probable prehistoric settlement remains focussed on Parcel 7. However, the caveats noted above regarding the variable drift geology in the site resulting in variable visibility of cropmarks, combined with the poor availability of control points for georeferencing entails a note of caution in the reliability of the results. As such, the 'Confidence' rating applied to the digitised features should be considered when assessing the reliability of identification.

8 Bibliography

AOC 2018 *A9/A96 Inshes to Smithton, Inverness, Scotland: Archaeological Geophysical Survey and Aerial Imagery Analysis*, Unpublished Report for Jacobs UK.

British Geological Survey (BGS) 2017 Geology of Britain Viewer, online at http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Scotland's Soils 2018 National Soils Map of Scotland online at http://soils.environment.gov.scot/

Appendix 1: Images Consulted

NRHE Canmore Oblique Images

B_23530.tif
B_23531.tif
B_23532.tif
B_23533.tif
C_52909.tif
C_52910.tif
C_52912.tif
C_52913.tif
C_53548.tif
C_53549.tif
D_74342.tif
D_74343.tif
D_74344.tif
IN_3613.tif
IN_3615.tif
IN_5491.tif
IN_5492.tif
C53550.tif

NCAP Vertical Images

A_0041 F5091.jpg
A_0041 F5092.jgwx
A_0041 F5092.jpg
A_0041 F5092.jpg.aux.xml
A_0069 F2004.jpg
A_0069 F2005.jgwx
A_0069 F2005.jpg
A_0069 F2005.jpg.aux.xml
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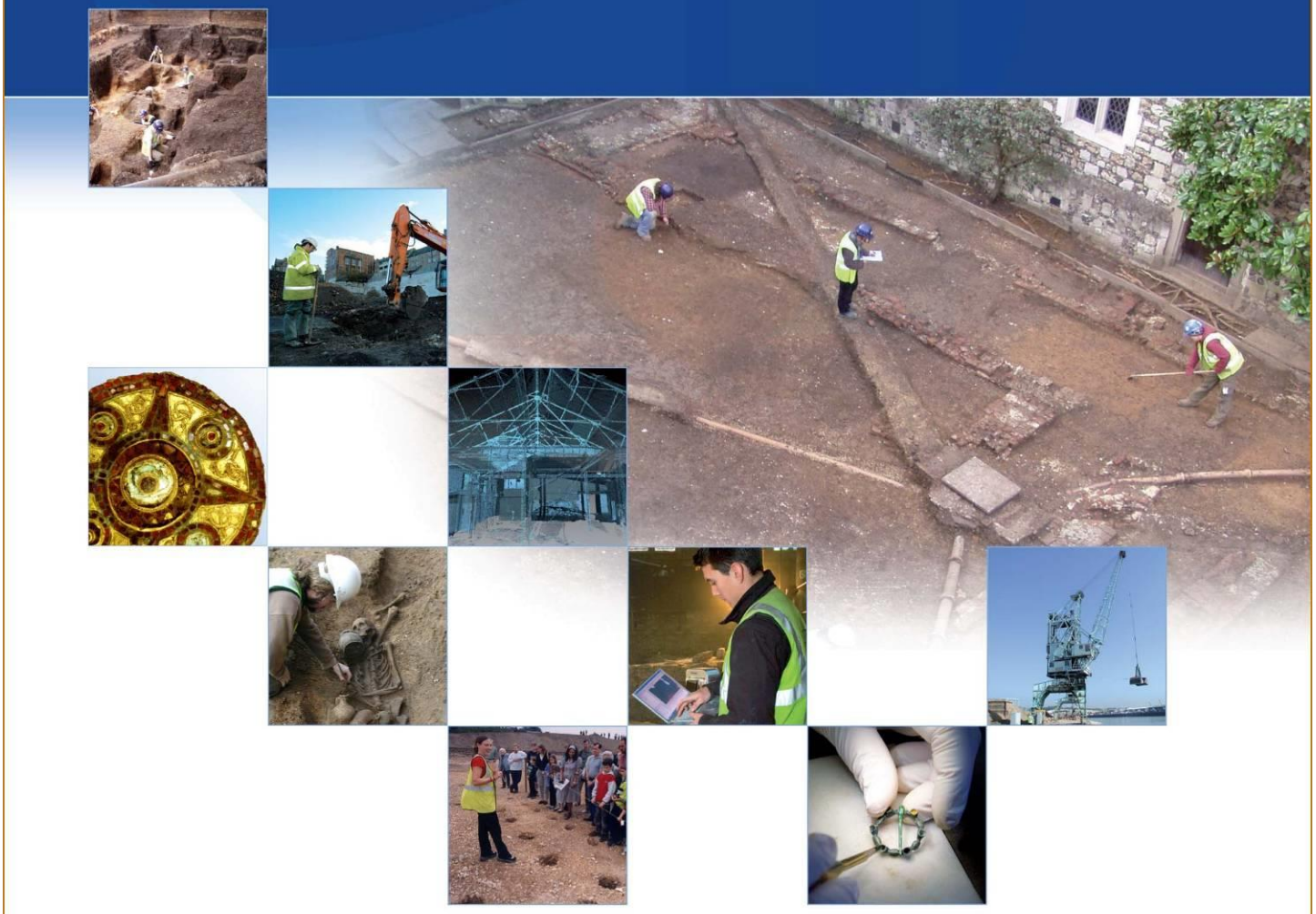
A_0069 F5004.jpg.aux.xml
B_0096 F2373.jgwx
B_0096 F2373.jpg
B_0096 F2374.jpg
B_0356 F0046.jpg
B_0461 F0058.jpg
B_0461 F0059.jpg
B_0461 F0060.jpg
B_0461 F0061.jpg
B_0744 F6575.jpg
B_0744 F6576.jpg
B_0744 F6577.jpg
B_0744 F6578.jpg
B_0744 F6579.jpg

Appendix 2: Digitised Features

HES Image No	Class	Description	Confidence	Study ID
C_52911	Roundhouse	Circular ring groove, 15m in diameter with probable entrance on south west.	3	AOC_AP1
C_52911	Pit	Sub-circular pit 3.5m in diameter, northwest of ring groove AP1.	3	AOC_AP2
C_52911	Pit	Circular pit within ring groove AP1, 2.3m in diameter.	3	AOC_AP3
C_52911	Pit	Amorphous possible pit feature, 7.7m in length, located immediately southwest of AP1.	3	AOC_AP4
D_74343	Linear feature (possible)	Curvilinear cropmark faintly visible running from north to southwest, for a length of c.155m. May be geological or agricultural in origin.	1	AOC_AP5
C_52913	Ring groove	Penannular ring groove	3	AOC_AP6
C_52913	Ring groove (possible)	Penannular ring groove, c 8m in diameter	1	AOC_AP7
C_52913	Ring groove (possible)	Fragment of ring groove (possible), c. 8.6m in diameter	1	AOC_AP8
D_74343	Structure (possible)	Dark sub-circular pit c. 10.6m across, possible structure.	1	AOC_AP9
D_74343	Structure (possible)	Penannular structure c. 7.7m in diameter visible as a light circle.	1	AOC_AP10
D_74343	Pit (possible)	Possible pit feature visible as a light circle c.2.8m in diameter.	1	AOC_AP11
C_52913	Ring groove (possible)	Dark annular ring groove, c. 9.5m in diameter.	1	AOC_AP12
D_74343	Structure (possible)	Dark circular feature visible, measuring c. 9.2m in diameter.	2	AOC_AP13
C_52913	Souterrain (possible)	Elongated oval negative feature visible south of roundhouse. 12m in length, 3.7m in width.	2	AOC_AP14
C_52909	Pit (possible)	Possible pit feature visible as a dark circle c. 2.5m across.	2	AOC_AP15
D_74343	Structure (possible)	Oval negative feature oriented northeast/southwest, measuring 13.2 by 8.1m. Break on west side may indicate entrance.	2	AOC_AP16

C_52913	Curvilinear feature (possible)	Fragment of curvilinear negative feature, visible as dark line c. 11m in length.	1	AOC_AP17
D_74343	Linear feature (possible)	Branching linear feature.	1	AOC_AP18
D_74343	Linear feature (possible)	Interrupted linear feature is curving to north field boundary of parcel 10. Two breaks are visible, each c.2.1m across.	2	AOC_AP19
C_52913	Pit (possible)	Dark negative feature c. 3.2m across.	2	AOC_AP20
C_52909	Ring groove (possible)	Fragment of curvilinear ring groove, forming a segment of circle c. 10m across.	1	AOC_AP21
C_52909	Ring groove (possible)	Faint penannular circle visible as dark circle c. 7.5m in diameter.	1	AOC_AP22
C_52909	Pit/structure (possible)	Dark sub-circular feature c. 6m in diameter.	1	AOC_AP23
D_74343	Linear feature (possible)	Linear cropmark visible curving from north to southeast, c. 87m in length. Possibly geological in origin.	1	AOC_AP24
D_74343	Linear feature (possible)	Linear feature visible as dark cropmark running north/south for a length of c. 70m.	1	AOC_AP25
D_74343	Linear feature (possible)	Linear cropmark visible as a dark feature running north/south. Possibly geological in origin.	1	AOC_AP26
D_74343	Linear feature (possible)	Linear cropmark visible as dark feature 40m in length. May be geological in origin.	1	AOC_AP27
D_74343	Linear feature (possible)	Linear cropmark visible as dark feature c. 54m in length. Feature curves from north to southeast. May be geological in origin.	1	AOC_AP28
D_74343	Pit (possible)	Possible pit feature visible as dark circle c. 4.8m across.	1	AOC_AP29
C_53549	Ring groove (possible)	Dark feature probably representing a ring groove structure c. 13m in diameter, associated with pits/postholes in interior.	2	AOC_AP30
C_53549	Structure (possible)	Dark curvilinear ditch feature, possibly representing a ring ditch or related structure.	2	AOC_AP31
B_0744 F6576	Field boundary	Linear negative feature; probable field boundary	3	AOC_AP32



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